

Is Yeast Alive?

Adapted from "Is Yeast Alive?" by Penny Bernstein at Kent State University, Stark Campus
copyright 2008 by Dr. Ingrid Waldron and Jennifer Doherty, University of Pennsylvania Biology Department¹

Humans use yeast every day. What is yeast, and what are some common uses of yeast?

You can buy yeast to make bread in the grocery store. This yeast consists of little brown grains. Do you think that these little brown grains of yeast are alive? Why or why not?

To find out whether yeast is alive, we first need to think about what makes something alive. What are some characteristics of living organisms?

To begin to answer the question, "Is yeast alive?", you will test whether the grains of yeast have two characteristics of living things -- the ability to grow and the ability to use energy (referred to as metabolism).

Scientific Experiment to Test for Metabolism

We will carry out an indirect test for metabolism. In other words, we will be indirectly testing whether yeast can use energy, which is one of the characteristics of living organisms.

When yeast, humans, and other living organisms use energy, they break down high-energy molecules like sugar to get the energy they need and give off a gas called carbon dioxide as a by-product of this reaction.

We will test whether yeast can metabolize sugar and produce a gas which we will presume is carbon dioxide. Specifically, we will test whether yeast produces a gas when it has sugar available as a food vs. when no sugar is available.

¹ Teachers are encouraged to copy this student handout for classroom use. A Word file (which can be used to prepare a modified version if desired), Teacher Preparation Notes, comments, and the complete list of our hands-on activities are available at http://serendip.brynmawr.edu/sci_edu/waldron/.

Research Question:

Does yeast metabolize sugar and produce a gas?

Predictions:

Do you expect yeast to produce a gas when sugar is available? _____

Do you expect yeast to produce a gas when no sugar or other food is available?

Explain the reasons for your predictions.

Procedure to Test Your Predictions

1. Set up four test tubes in a test tube rack.
2. Label each tube with a number, 1-4. Test tubes 1 and 2 will both have yeast, sugar and water. Test tubes 3 and 4 will both have only yeast and water, with no sugar.
3. Fill test tube 1 $\frac{4}{5}$ full with warm tap water. Add one packet of dry yeast a little bit at a time, mixing the yeast in thoroughly before adding more. Mix by putting your hand or thumb over the top of the test tube and shaking.
4. Pour the yeast solution so that there is an equal amount in each of the four test tubes.
5. Add $\frac{1}{2}$ packet of sugar to test tube 1 and the other half to test tube 2. These tubes will be your experimental group. Do not add sugar to tubes 3 and 4.
6. Add warm tap water to each test tube, filling each test tube $\frac{4}{5}$ of the way to the top.
7. Cover the opening of each test tube with a balloon to catch any gas that is formed. Using the balloon to seal the end of the test tube, hold a finger over the end of each test tube and shake it vigorously to thoroughly mix the contents.
8. Observe the test tubes and record your observations carefully in the table on the next page. Then, every 5 minutes for 25 minutes, observe what occurs in the test tubes and any changes in the balloons which cover each test tube, and record your observations.

If the yeast grains are capable of metabolism, it will take some time to produce enough carbon dioxide to see the change in the balloons. While you are waiting for this change, set up the experiment to test growth, which is described on page 4.

	0 minutes	5 minutes	10 minutes	15 minutes	20 minutes	25 minutes
Test tube 1						
Test tube 2						
Test tube 3						
Test tube 4						

9. Discuss the results you obtained with your group. How do you interpret your results?

10. Why is it better to have two test tubes with yeast, sugar, and water and two test tubes with just yeast and water, instead of only one test tube with each type of mixture?

11. When you make bread, if you just mix flour, sugar and water, the dough does not rise, and the bread will be flat and hard. If you include yeast in the bread dough, then the dough rises and the bread is bigger and fluffier. Can you explain how the yeast helps the bread dough to rise?

Procedure to Test for Growth

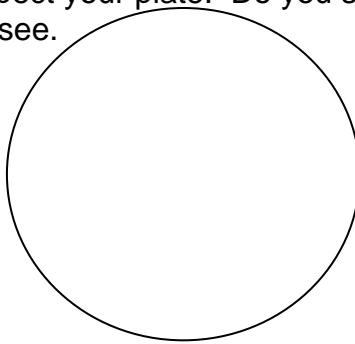
Research Question: Can the little brown grains of yeast grow?

Instructions

1. Obtain a Petri dish with yeast growth media, and label the bottom with your name, teacher, and class period. (A Petri dish is a flat, covered dish used by scientists, and the yeast growth media in the Petri dish contains a mixture of substances that yeast requires to grow.)
2. Spread 10-12 grains of yeast across your plate.
3. Add several drops of water on the grains of yeast.
4. Your plates will be incubated at 37° C until the next lab class. How warm or cold is that?
37° C is equivalent to _____ ° F.

Observations

5. At the next lab class, inspect your plate. Do you see any signs of growth on the plate? Sketch what you see.



6. Take a sample of the growth and observe it under the microscope. Describe what you see.

Conclusions

Based on your findings, do you think the little brown grains of yeast are alive? Explain why or why not.